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To The U.S.-U.S.S.R. Joint Commission
on Scientific and Technical Cooperation

REPORT

The U.S.-U.S.S.R. Coordinators on Scientific and Technical Cooperation in the Field of Application of Catalysis to Life Support Systems for Possible Use in Future Space Exploration herewith transmits to the U.S.-U.S.S.R. Joint Commission the Record of their first meeting at Moscow, June 10-20, 1973.

The Record, which is attached, lists the topics and projects proposed for initiation of scientific and technical cooperation in this field. The Coordinators recommend that the Joint Commission approve the proposed priority projects so that cooperative work may begin at an early date.

Chemical Catalysis

Alvin H. Weiss

Coordinator for the U.S. Part
of the Program
(Alvin H. Weiss)

Coordinator for the Soviet
Part of the Program
(Michael Michaelovich Sakharov)

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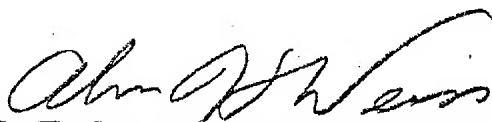
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Record of the First Meeting of the U.S.-U.S.S.R. Coordinators on
Approved For Release 2000/08/31 : CIA-RDP79-00798A000300020021-0
Scientific and Technical Cooperation in the Field
of Application of Catalysis to Life Support Systems for
Possible Use in Future Space Exploration

In accordance with the U.S.-U.S.S.R. Agreement on Cooperation in the Fields of Science and Technology of May 24, 1972, and with the decisions of the U.S.-U.S.S.R. Joint Commission on Scientific and Technical Cooperation at its March 19-21, 1973 meeting, the U.S.-U.S.S.R. Coordinators in the field of Applications of Catalysis to Life Support Systems for Possible Use in Future Space Exploration held their first meeting in Moscow, June 10-20, 1973. The plans developed for their collaboration are included in the attached appendix.

Professor Weiss visited the Institute of Organic Chemistry in Moscow and the Institute of Physical Chemistry in Kiev. The majority of his time was spent at the Institute of Chemical Physics in Moscow. Professor Weiss gave a lecture on "Kinetics, Mechanisms, and Instabilities of the Formose Reaction" at both the Institute of Chemical Physics and the Institute of Physical Chemistry.

Moscow,



Coordinator for the U.S. Part
of the Program
(Alvin H. Weiss)

Coordinator for the Soviet
Part of the Program
(Michael Michaelovich Sakharov)

APPENDIX

Research in the USSR-US Program in Chemical Catalysis

"Application of Catalysis to Life Support Systems
for Possible Use in Future Space Exploration"

March 19, 1973

I Purpose of Collaboration:

The development of both the catalytic systems and the fundamental understandings that are necessary to transform the waste products of outer space exploration into carbohydrates and other products.

II Problems that might be investigated in the course of five years:

1. Catalysis of the formose condensation and the Cannizzaro reactions:

a. Establish the nature of the complex by UV and NMR studies under reacting and non-reacting conditions. b. Establish the rate behavior with homogeneous catalysts of the same valence (e.g., $\text{Pb}(\text{OH})_2$ and $\text{Ca}(\text{OH})_2$) and other valences (e.g., TlOH , $\text{Sm}(\text{OH})_3$ and $\overset{\text{Ce}}{\text{Pr}}(\text{OH})_4$), and their effects on selectivity. c. Determine the role of pH in the reaction. d. Establish the techniques necessary to shift the reaction from homogeneous to heterogeneous.

2. Kinetics and mechanisms of other reactions in the formose system:

a. Quantitatively measure aldose-ketose shifts and anomerization. b. Study the effect of reaction medium (e.g., CH_3OH). c. Conduct both continuous and batch reaction studies using UV and other instrumental analysis methods. d. Study the reverse reaction using C^{14} tracer methods.

3. Isolation and characterization of products produced
in the formose reaction:

a. Develop qualitative and quantitative analytical techniques. b. Use fermentation and chromatographic techniques to isolate unique branched species. c. Chemically and physically characterize branched species and compare them to known compounds. d. Study the hydrogenation of formose products to polyols.

4. Biological effects of branched aldoses, ketoses, and polyols:

a. Using species produced in 3b, conduct studies to establish the metabolic pathways and products that are the cause of the toxicity of formose.

5. Mathematical analyses of the reaction kinetics, oscillations, and instabilities.

6. Conduct investigations of the other problems that may arise and become important in the course of the research.

III First Year Activities and Participants

1. Development of methods for analyzing complex carbohydrate mixtures (Institute of Physical Chemistry of the Ukrainian SSR Academy of Sciences [IPC, AN UkSSR] -- corresponding member of the UkSSR, Ya. B. Gorokhovatsky; Worcester Polytechnic Institute -- Prof. A. Weiss).

2. Use of UV and NMR spectroscopy to study the nature of formaldehyde and carbohydrate complexes with Ca^{2+} ions, active in reactions of aldol condensation in alkali environment

-3-

(Institute of Chemical Physics [ICP], AS USSR -- Prof.

O.V. Krylov; Candidate of Chemical Science [c.c.s.], M. M.

Sakharov), and preparatory work on the use of these methods to study the nature of complexes formed with the participation of cations of Pb^{2+} and rare earth elements (ICP, AS USSR -- Prof. O. V. Krylov; c.c.s. M.M. Sakharov; IPC AU UkSSR -- corr. member Ya. B. Gorokhovatsky).

3. Use of radioactive tracers to study the role of reactions of retroaldol fission in the process of condensation of formaldehyde into carbohydrates (ICP, AS USSR -- Prof. O. V. Krylov; c.c.s. M. M. Sakharov).

4. Continuing analysis and reaction studies as well as a study of the possibility of transferring from the use of a homogenous catalyst to a heterogenous one in the synthesis of carbohydrates from formaldehyde (Worcester Polytechnic Institute -- Prof. A. Weiss).

5. Use of fermentation and hydrogenation to separate complex mixtures of carbohydrates and obtain individual carbohydrates and polyols (Worcester Polytechnic Institute -- Prof. A. Weiss).

The following invitations to participate in the joint US-USSR collaborative activities on toxicological and other problems will be submitted:

a. From Dr. Sakharov to a scientist of the Moscow Institute of Medical-Biological Problems, b. From Dr. Weiss to Dr. J. A. Shapira of the NASA Ames Research Center. Each will be requested to submit proposals that are in accord with their own research interests, with the goals and policies of the US-USSR Program in Chemical Catalysis, and which, of course, have the approval of their own institutions.

IV Possible Forms of Collaboration

1. Direct personal exchange of data, preprints, reprints, chemicals, and equipment.

2. Conduct experimentation on an equal man-month basis in each other's laboratories.

3. Write papers jointly and assist each other with translation.

4. Arrange scientific visits and tours for senior scientists.

V Possible Initial Visits

Unless there are particular reasons, Drs. Weiss and Sakharov (or other scientists of the same rank in this area of research) will meet at least once per year in the USSR and USA, alternately. Visits of senior personnel to the US and USSR should be for approximately equal total time periods extending to as much as one and one-half man-months in the host country annually.

Visits of junior researchers will most probably commence in the second half of 1974 (excluding July and August in the USSR). It is expected that 1 or 2 US and USSR researchers will spend approximately three man-months in the alternative host countries annually.

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<p>Amended version of the record of the first meeting of US-USSR project coordinators in the field of application of catalysis to life support systems. (Copy of earlier record forwarded you August 1, 1973).</p> <p><i>ce</i></p>					
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